Climate Change in California: a threat to be contended with

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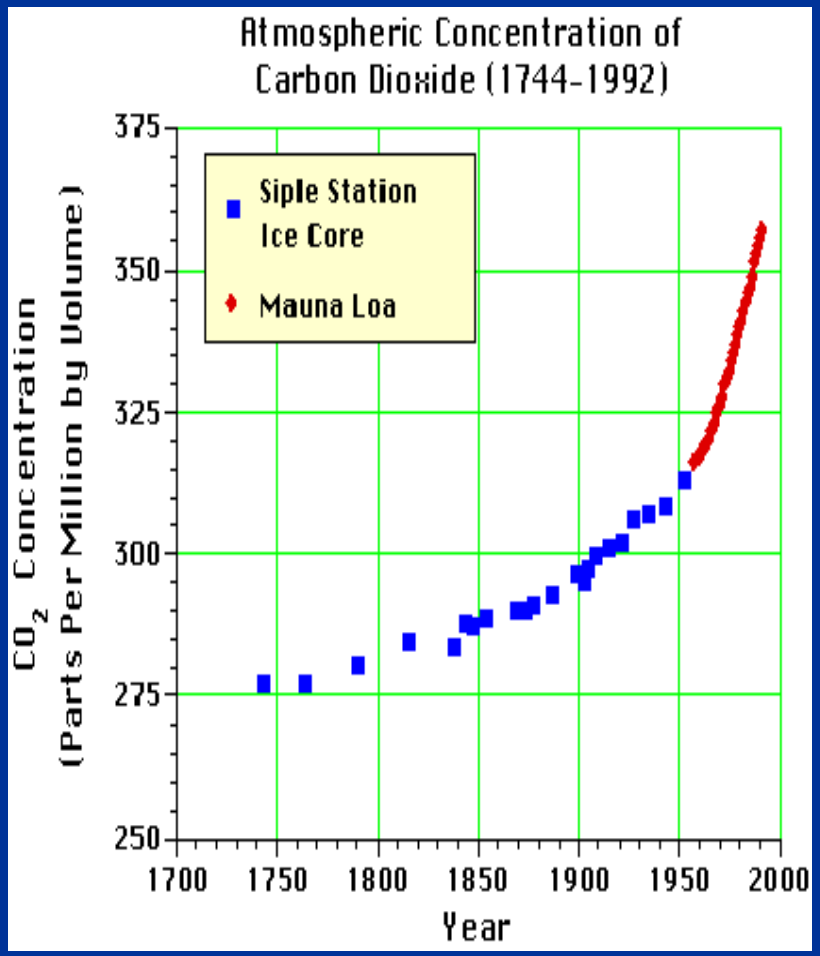
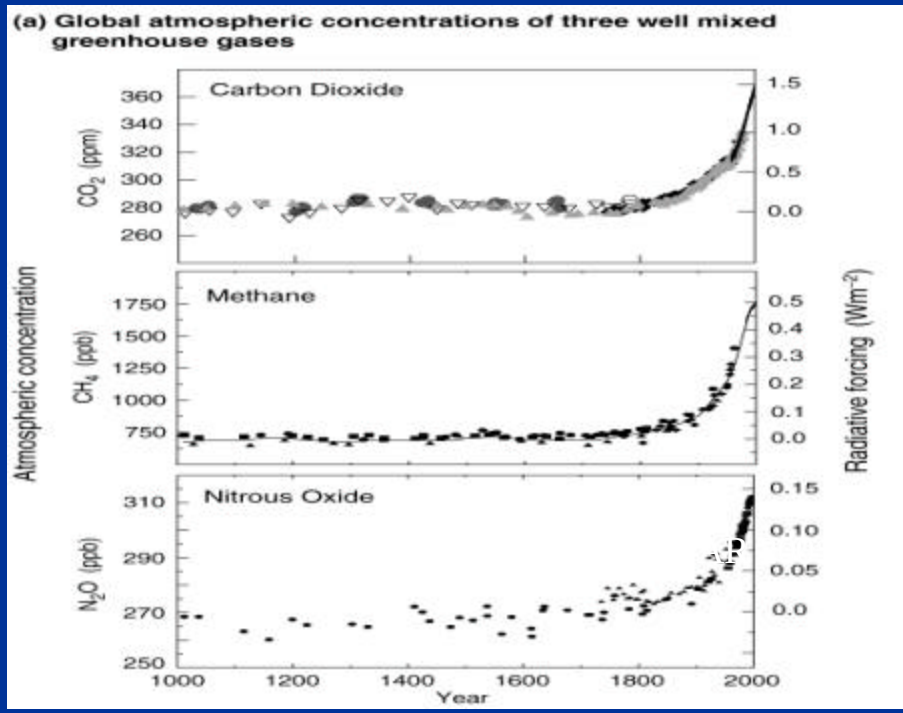
IPCC Third Assessment Report
Key Findings of Working Group I

"An increasing body of observations gives a collective picture of a warming world and other changes in the climate system."

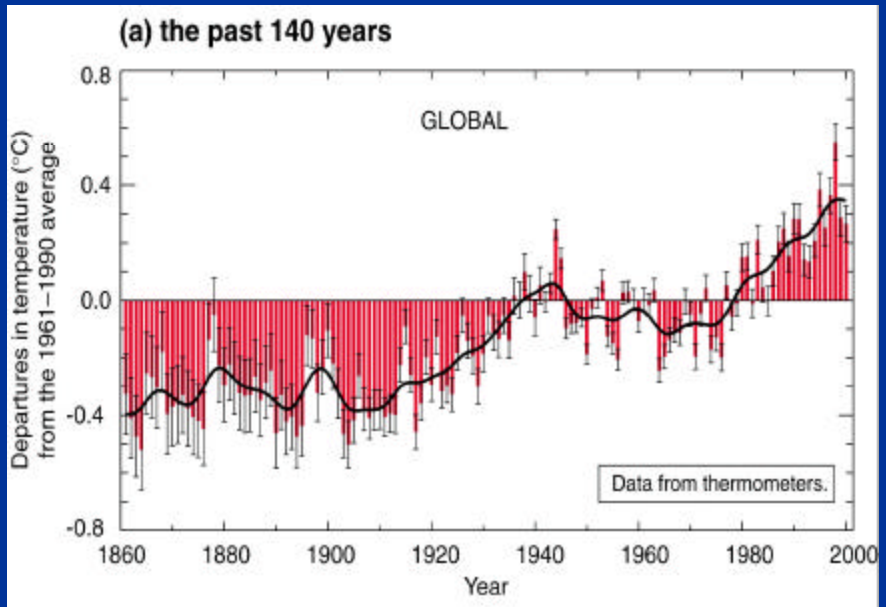
- Published in 2001
- Emphasizes information from the last 5 years
- Places climate change in the context of sustainable development, emphasizing equity issues
- Policy relevant, but not policy prescriptive

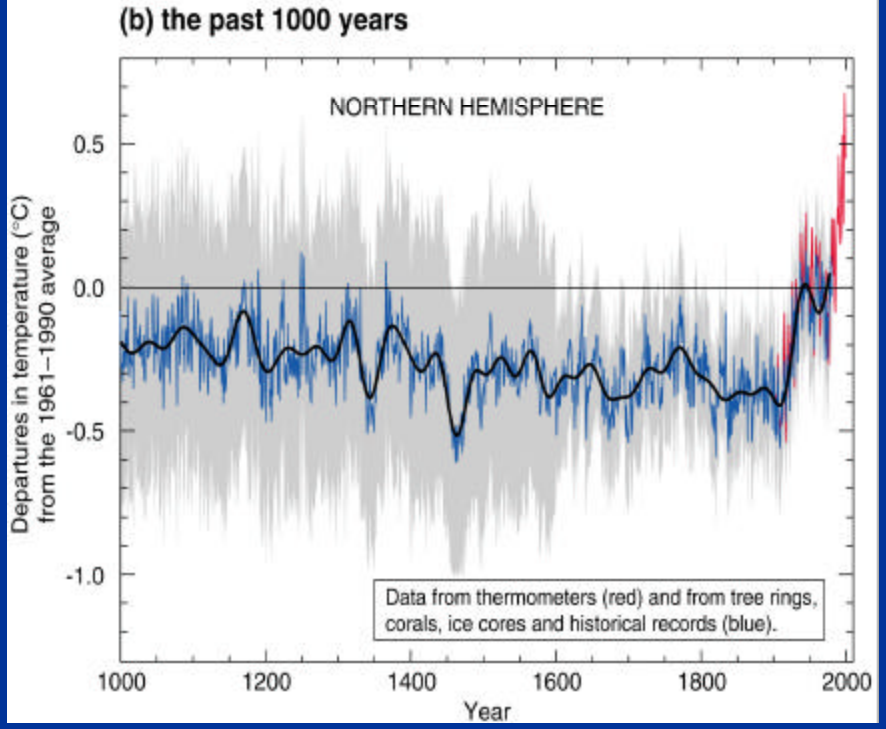
Humans have greatly Influenced the Atmosphere during the Industrial Era





While these seem to be very low concentrations, these trace gases are critical because they absorb infrared radiation and thus change the temperature of the atmosphere

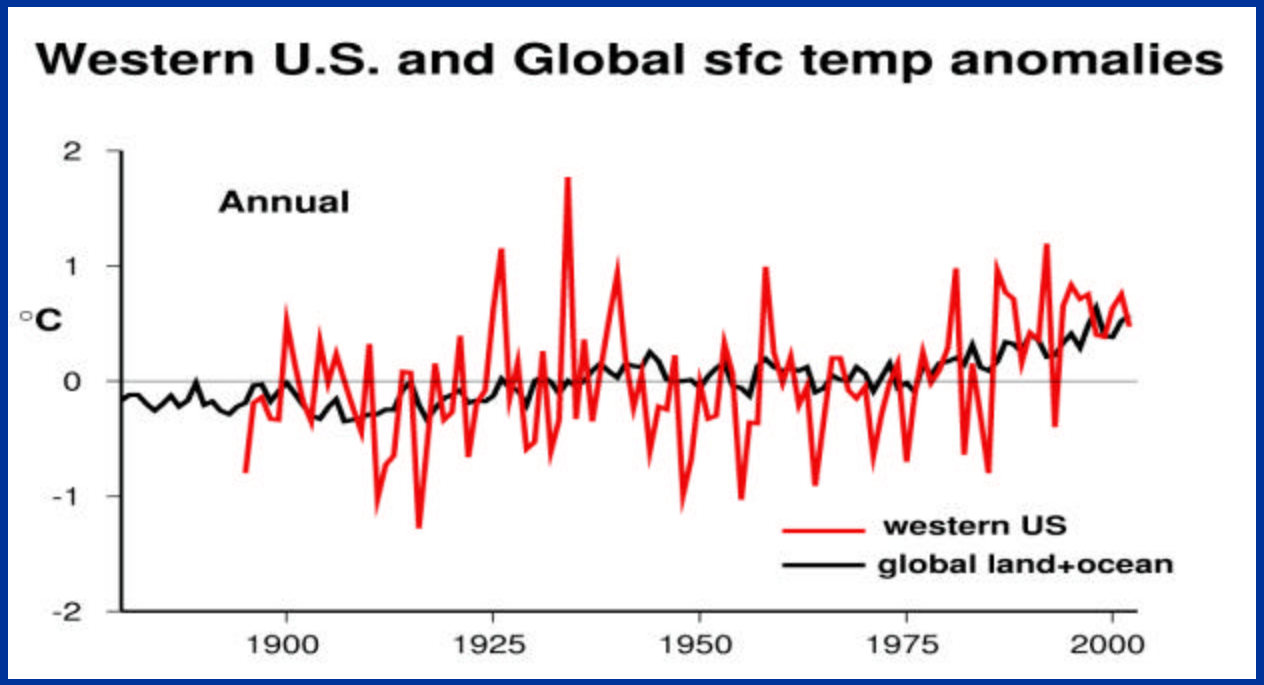


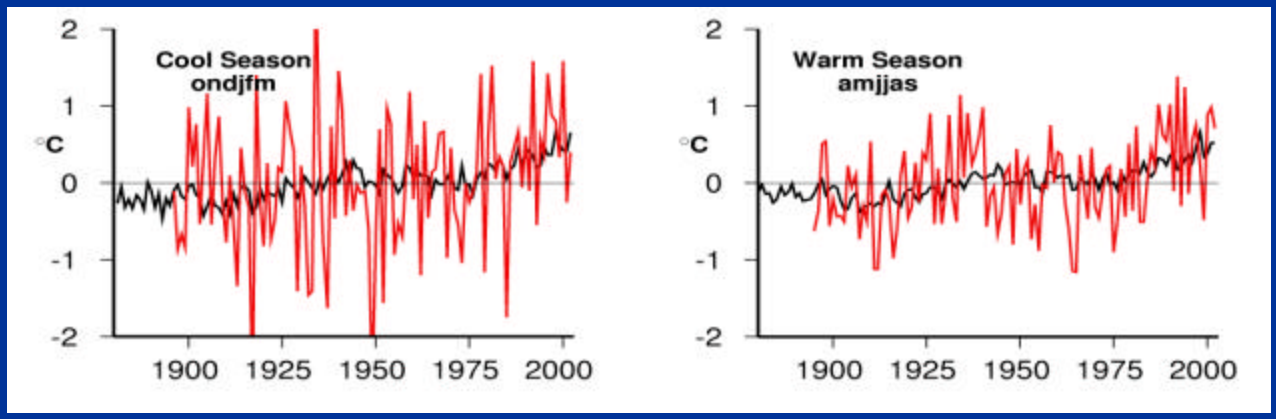


Earth's surface temperature* has warmed sharply during the last century, at an unprecedented rate during the last 1000 years

*relative to 1961-1990 average

Source: IPCC TAR 2001



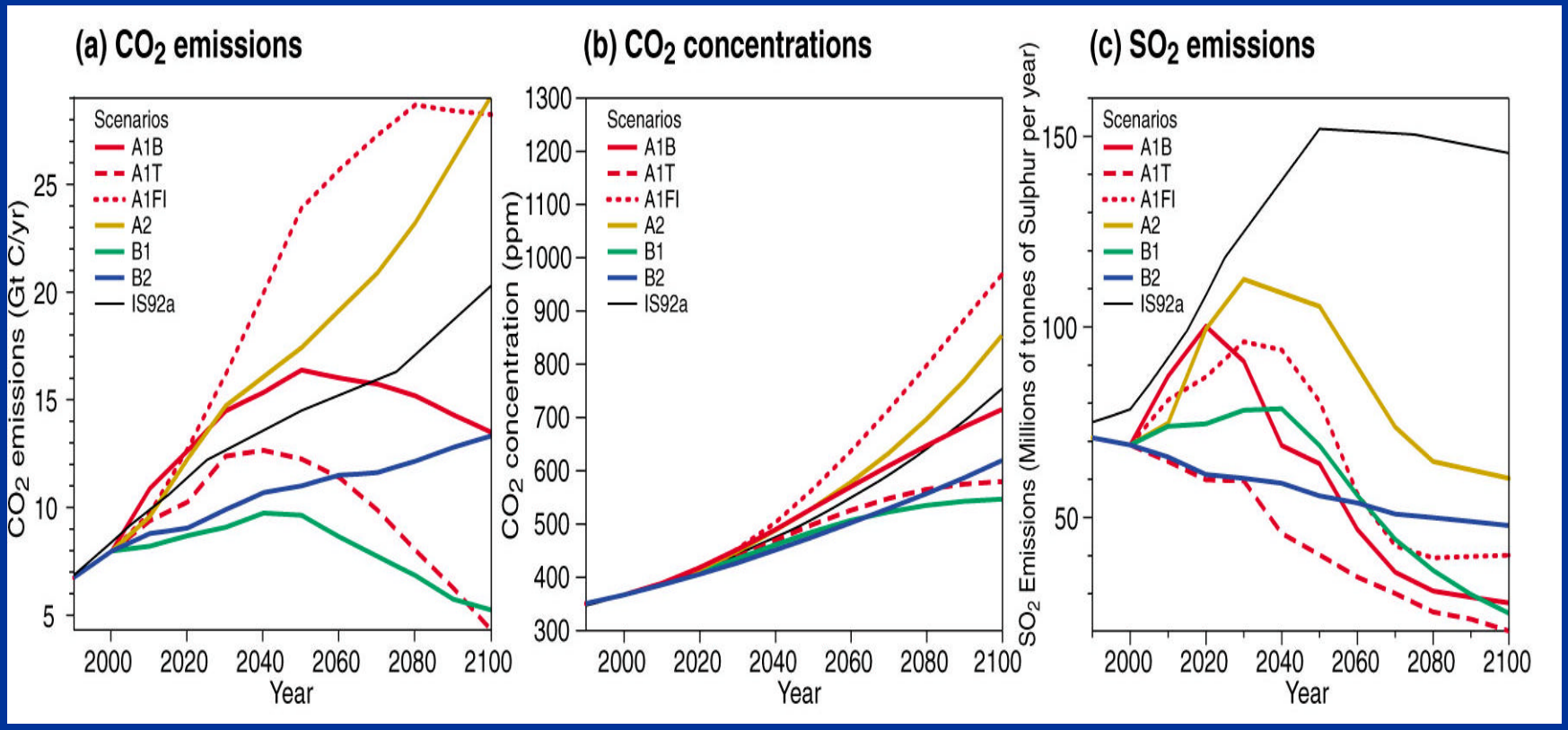


Global land data from the Global Historical Climatology Network (GHCN; Version 2) and global SST data from the UK MOHSST and NCEP OI SST (Version 2) anoms based on 1880-2002 mean

Western U.S. data from the time bias corrected NCDC statewide-regional-national dataset (Climate Division data) anoms based on 1895-2002 mean

CO_2 and SO_2 in the 21st Century

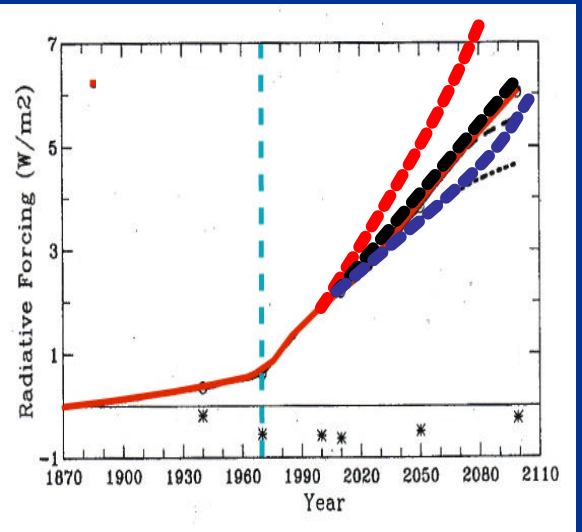
Different emissions scenarios will have profound influence on earth's climate

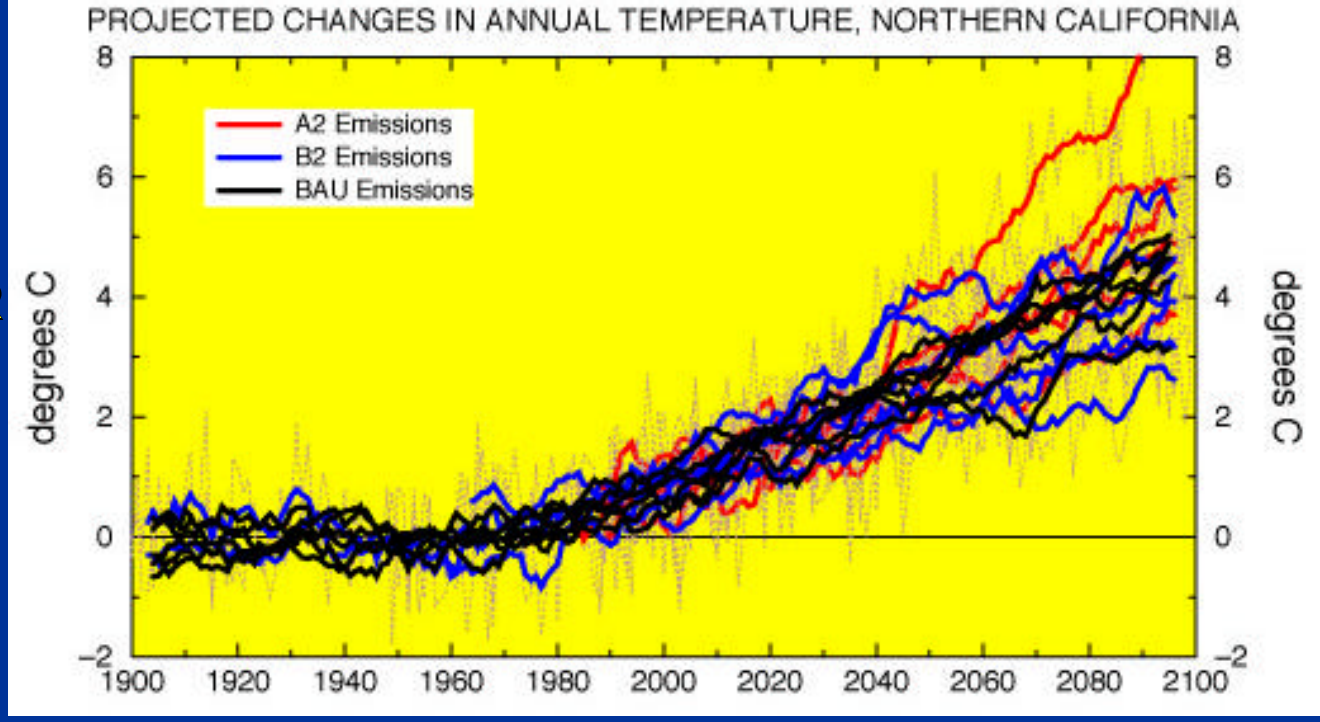


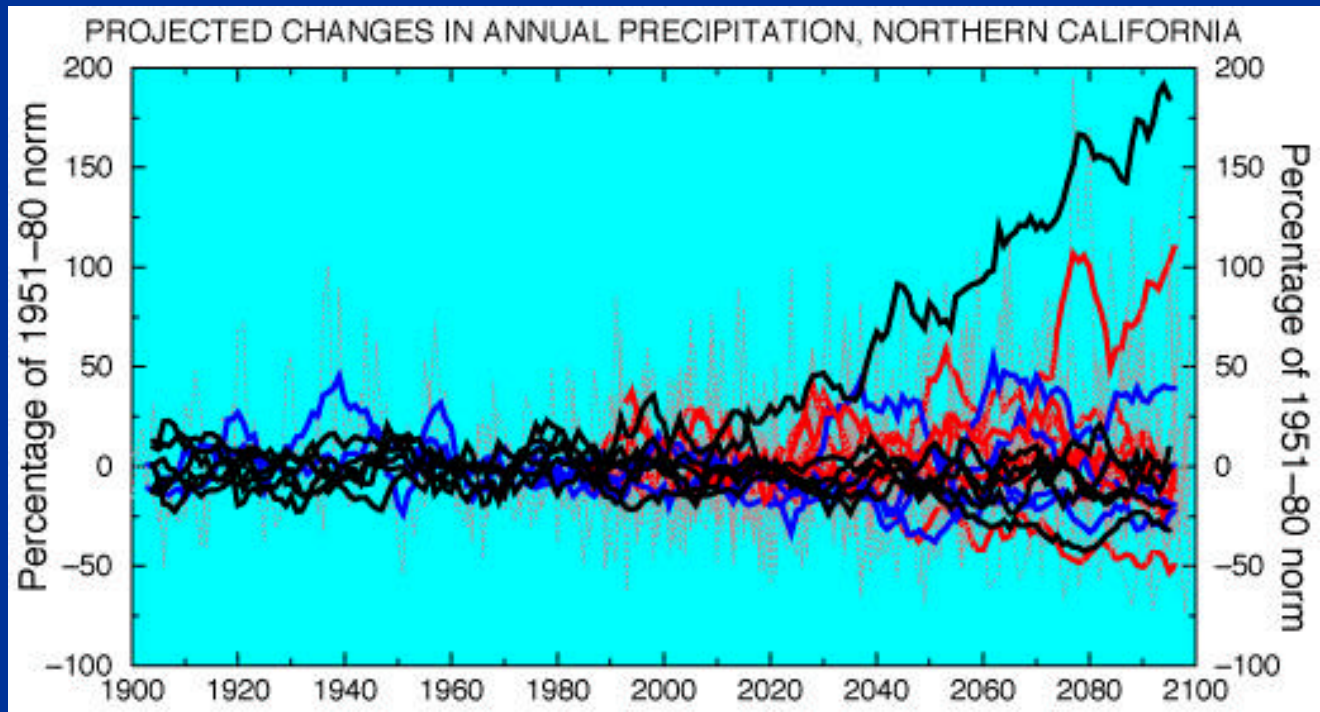
Source: IPCC TAR 2001

DIFFERENT ESTIMATES OF CALIFORNIA TEMPERATURE AND PRECIPITATION OVER THE NEXT CENTURY

Due to uncertainties about emission scenarios and scatter among different climate models



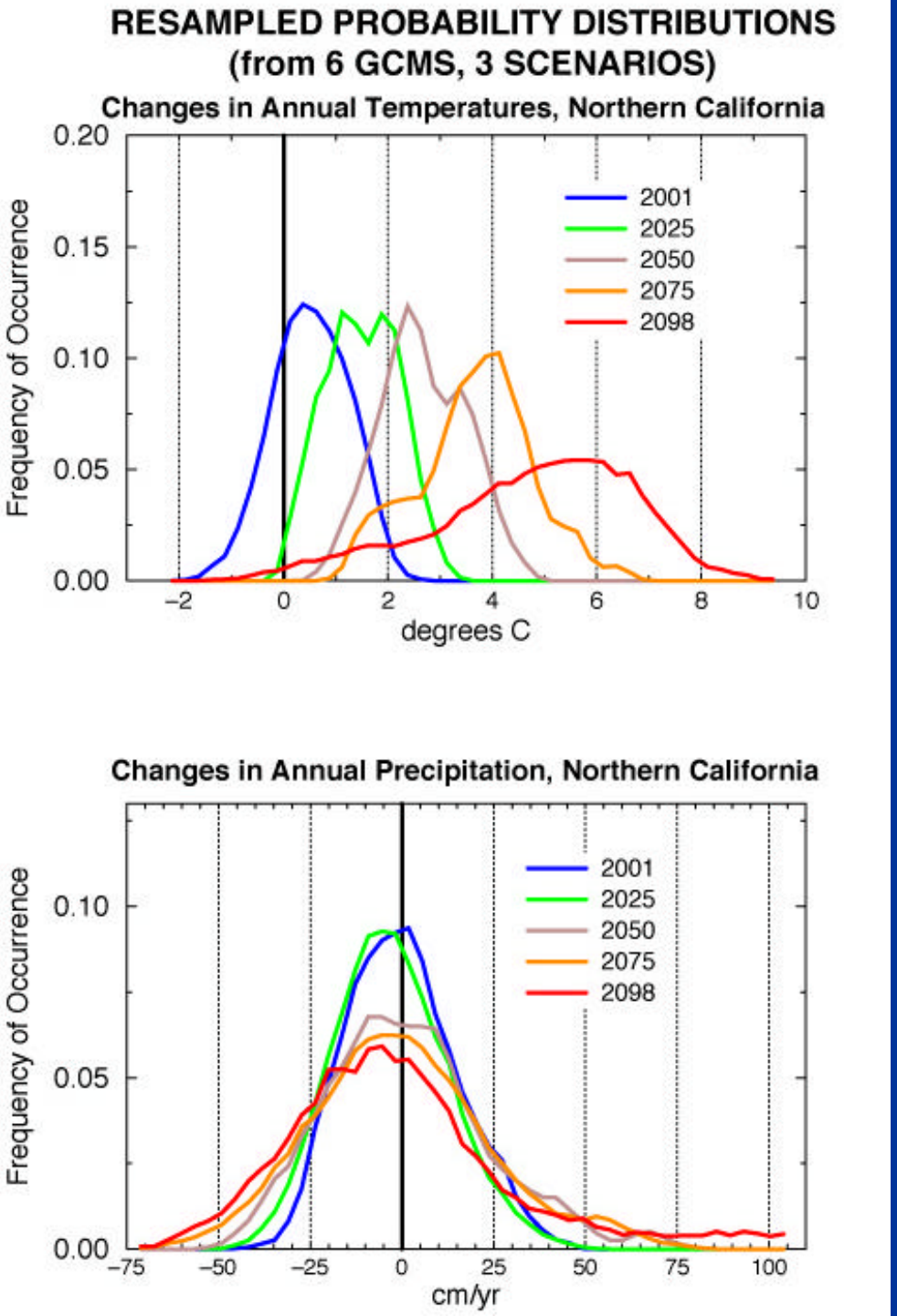




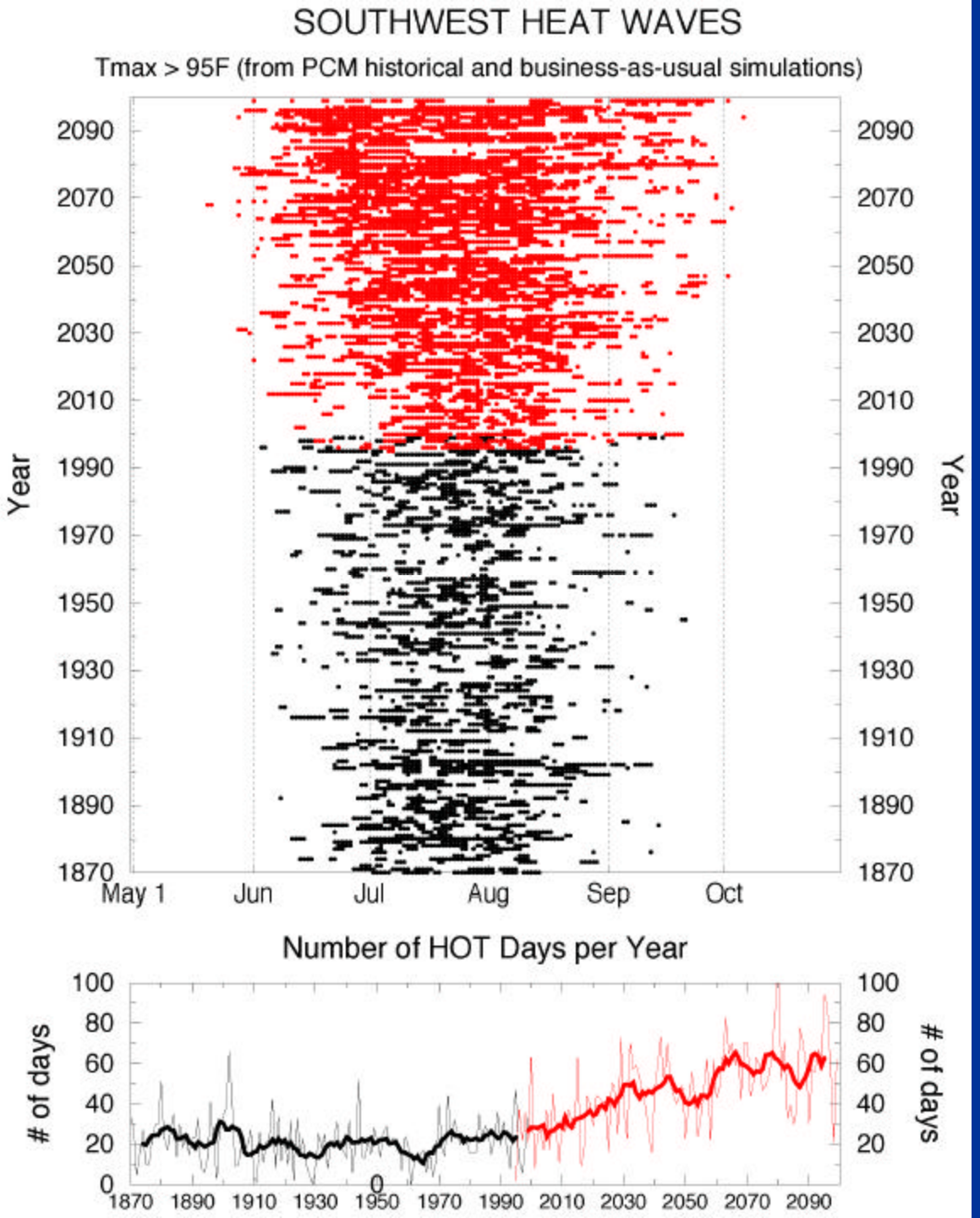
Probabilities of the changes in temperature and precipitation in California emphasize:

- Important temperature (& snowmelt) changes within about 20 years
- Strong tendency toward little precipitation change, with a hint of slightly drier
- General spreading of possibilities (espec. temperatures) due to model and emissions uncertainties

Mike Dettinger, USGS/SIO

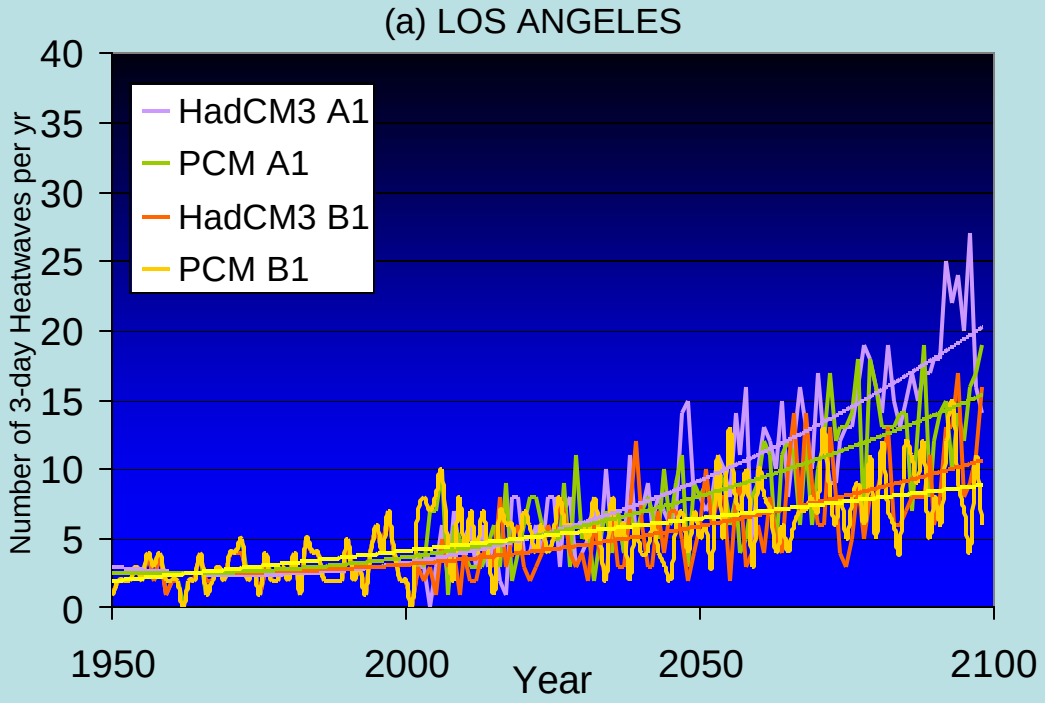


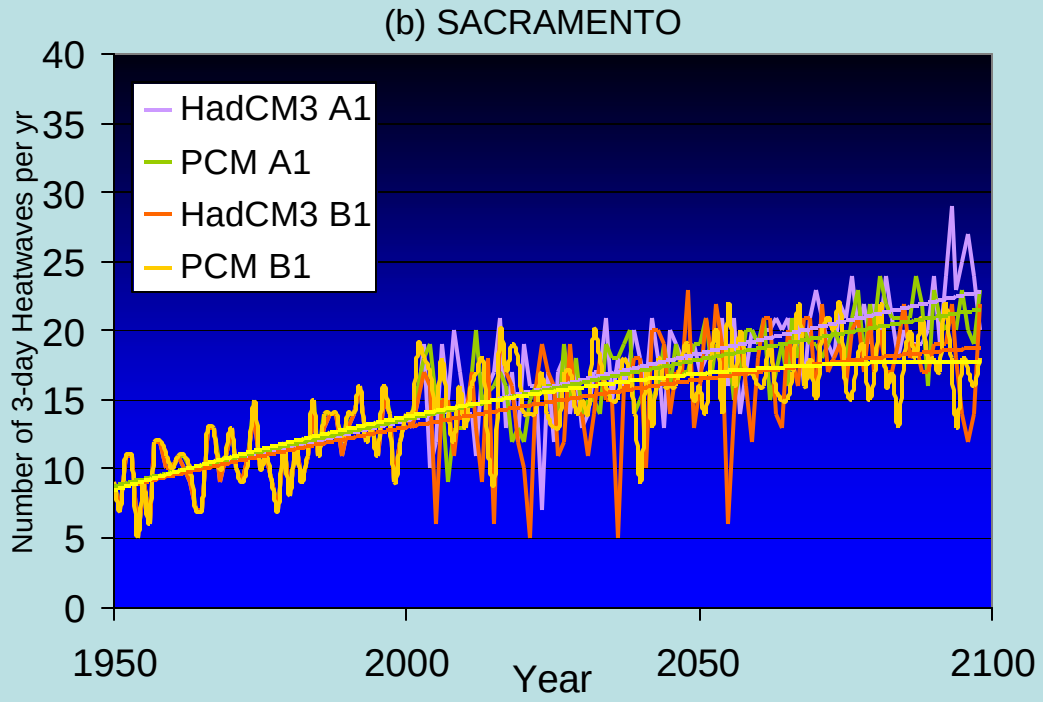
Even these moderate climate changes in average conditions translate into large changes in the extremes.



Mike Dettinger, f rom ACPI Parallel-Climate model simulations,

Frequency (and intensity) of 3-day heat waves is projected to increase markedly

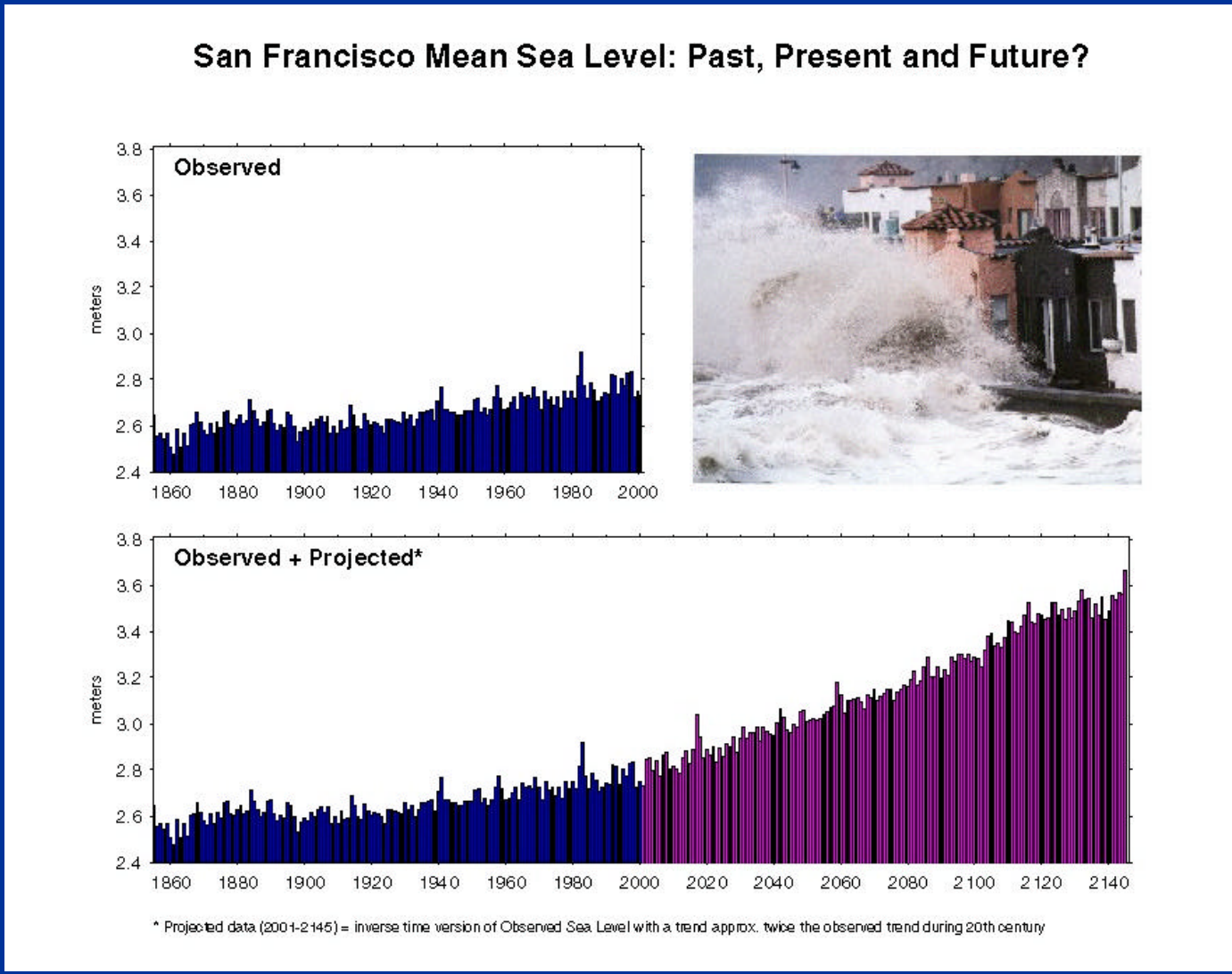




Union of Concerned Scientists

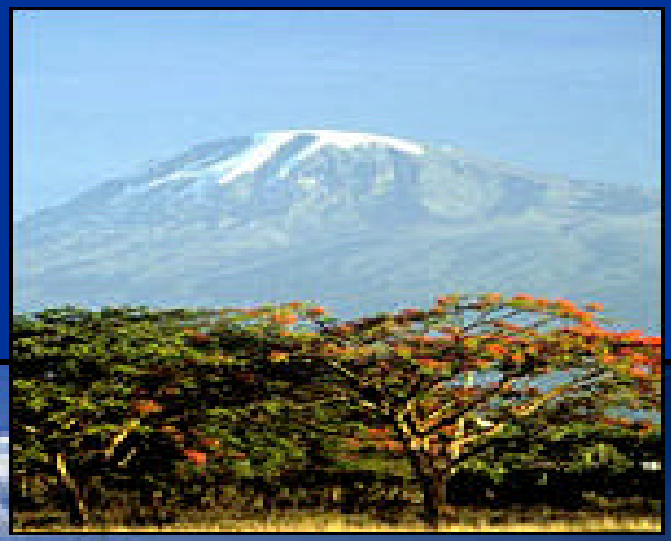
For more information about UCS, visit <www.ucsusa.org>.

The California coast is likely to face rather dramatic sea-level rises that may threaten its shoreline and its estuaries.

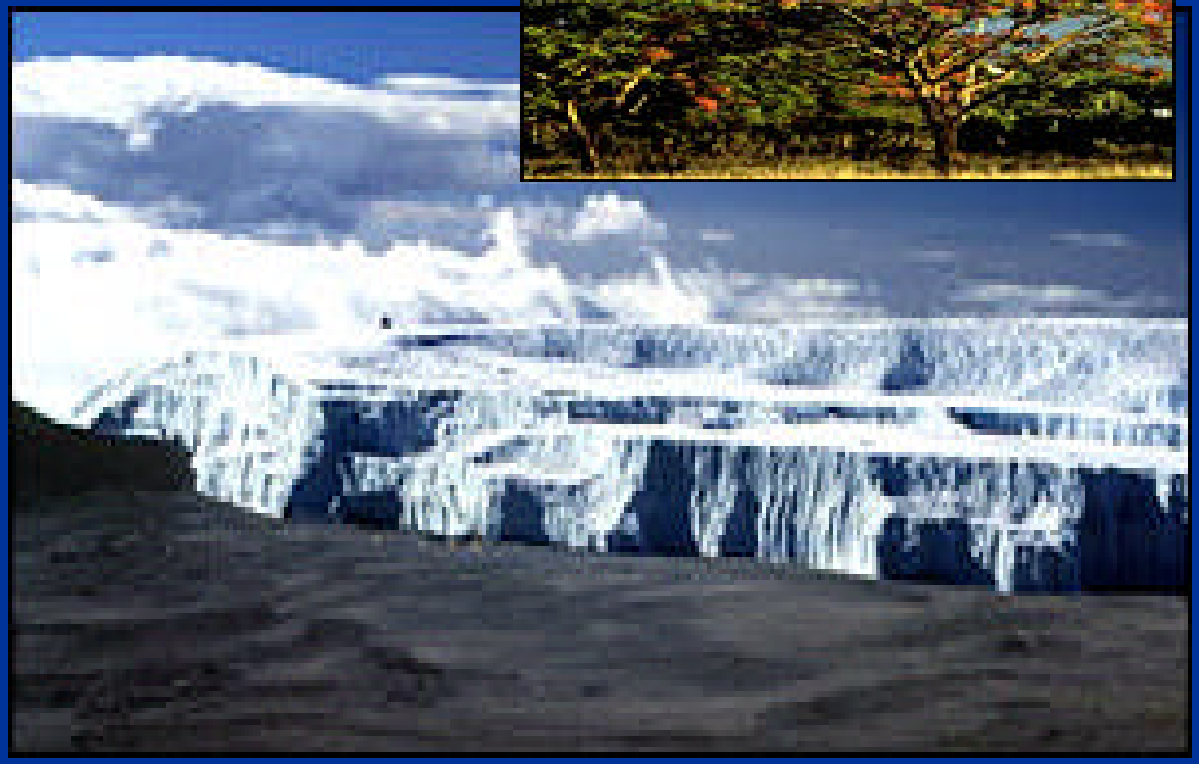


Kilimanjaro's ice archive

Prof. Lonnie Thomson, Ohio State Univ.

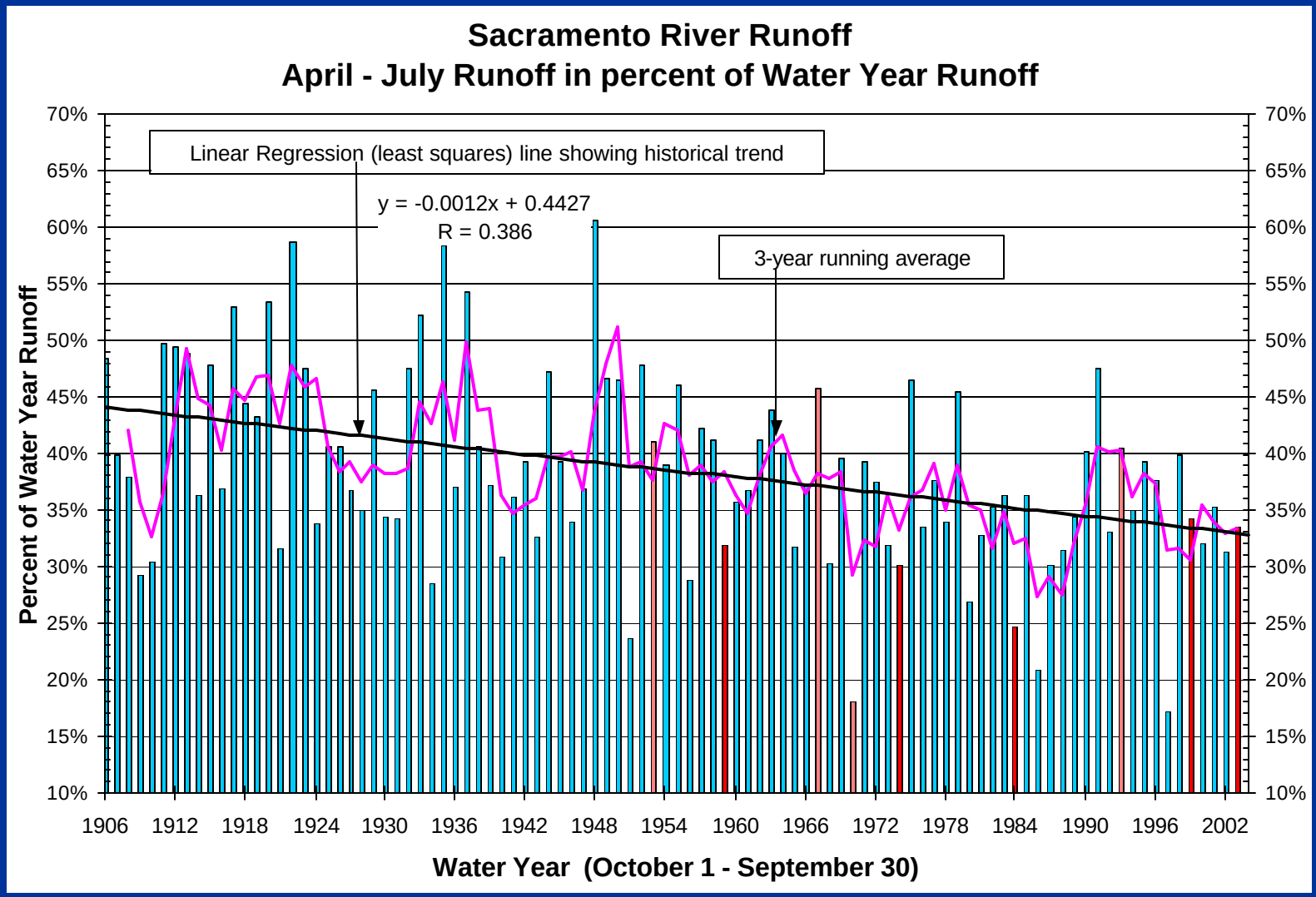


"We have a series of maps - the first made in 1912. "Since then, there have been five maps, the latest by us produced from aerial photographs taken February, 2000. That showed only 2.2 sq km of ice remained on the mountain - so we've lost about 80% of the ice since 1912.



"Evidence is mounting that human influences on climate are causing glaciers to retreat dramatically around the world, and especially at high elevations in the tropics. "

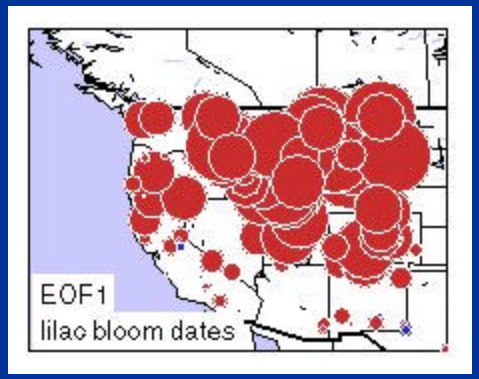
Snowmelt flow fraction has shown marked decline

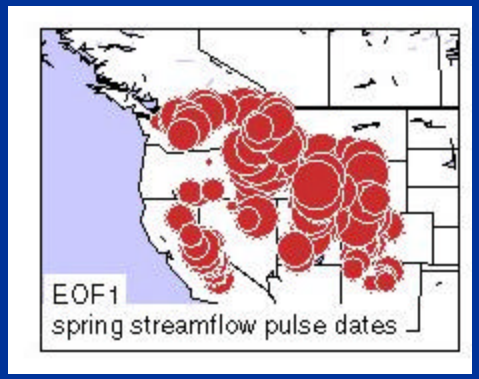


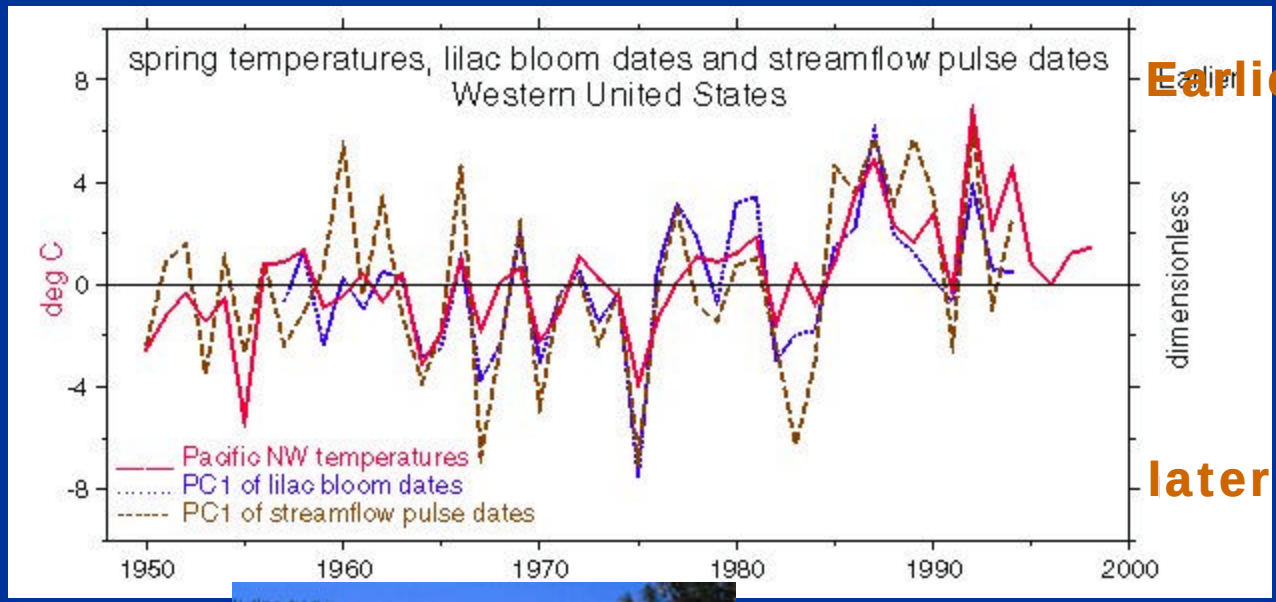
Maury Roos, Calif Dept Water Resources

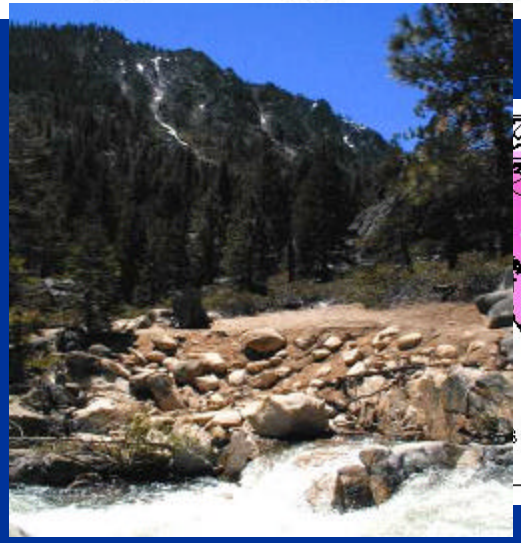
Spring has come earlier since the mid-1970's

snowmelt and plant blooms have advanced by 1-3 wks



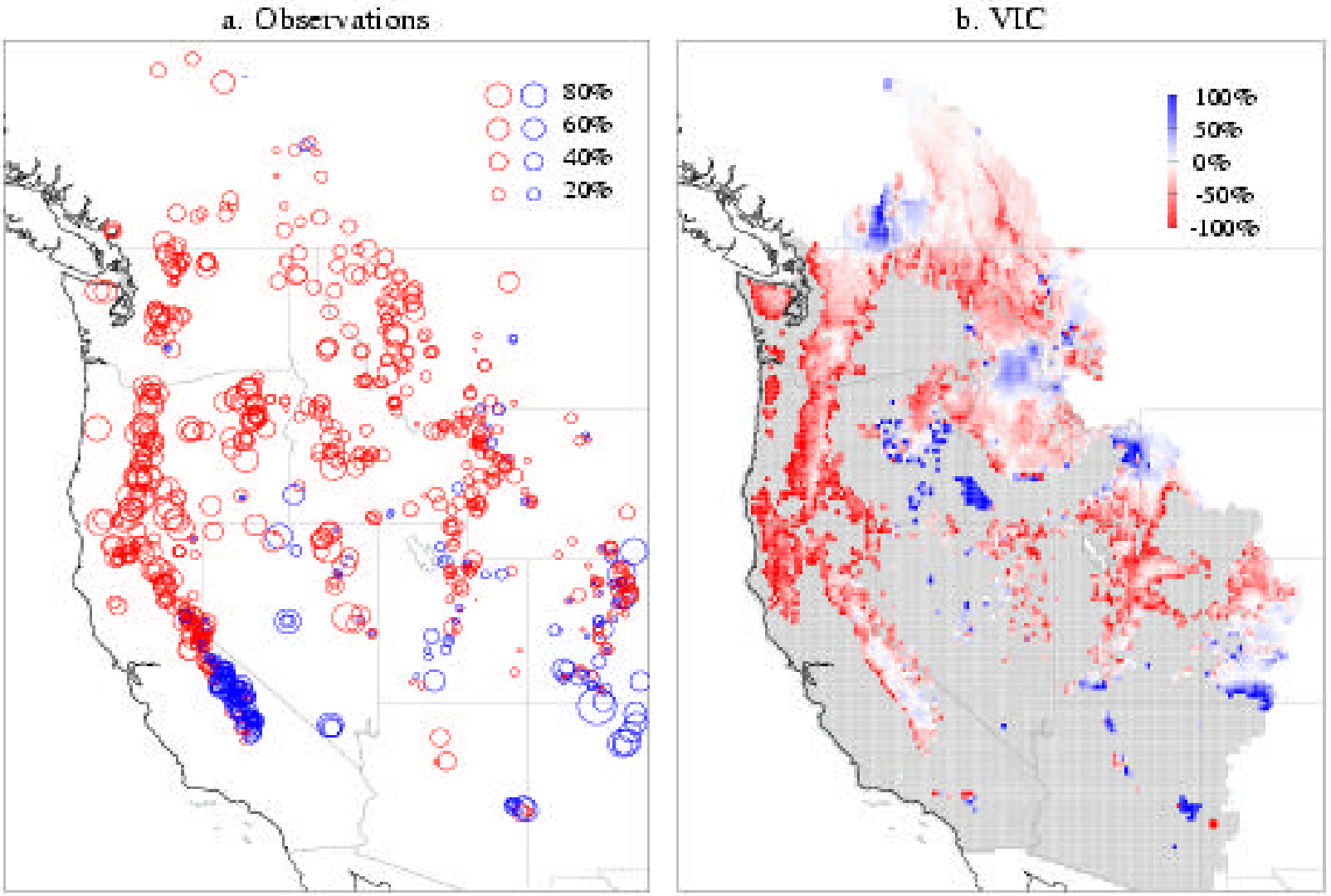






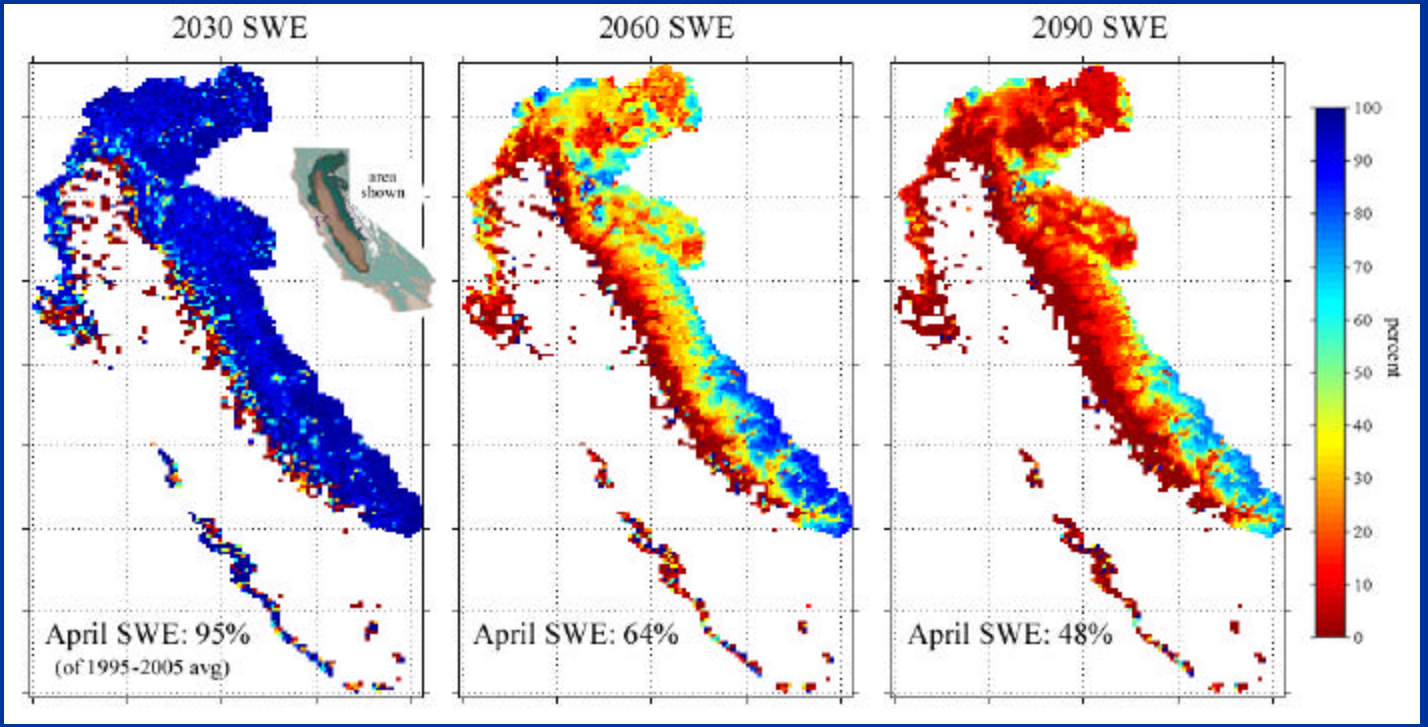
broad footprint of change across the West

Trends in April 1 Snow Water Equivalent 1950-1997



Source: Alan Hamlet, Phillip Mote, U. Washington (2004)

Will we lose our late spring snowpack?



By the end of the century California could lose half of its late spring snow pack due to climate warming. This simulation by Noah Knowles is guided by temperature changes from PCM's Business-as-usual coupled climate simulation.

Knowles and Cayan 2001 GRL

WHAT ARE OBSERVATIONS AND MODELS TRYING TO SAY?

Warming already underway and coming fast.

California temperature projections are broadly in consensus (+3 to +6 or more ºC by 2100), enough for earlier flows, more floods & drier summers.

California precipitation projections are a bit more scattered, with MOST showing small (drier?) changes but with a couple of outliers much wetter.

Estimated changes would likely have adverse impacts on California resources, such as water, ecosystems, coastlines, and human health.

Careful monitoring and modeling crucially needed.